

OCR A Level

Computer Science

H446 – Paper 1



Types of Operating System

Unit 2
Systems software
and applications
generation



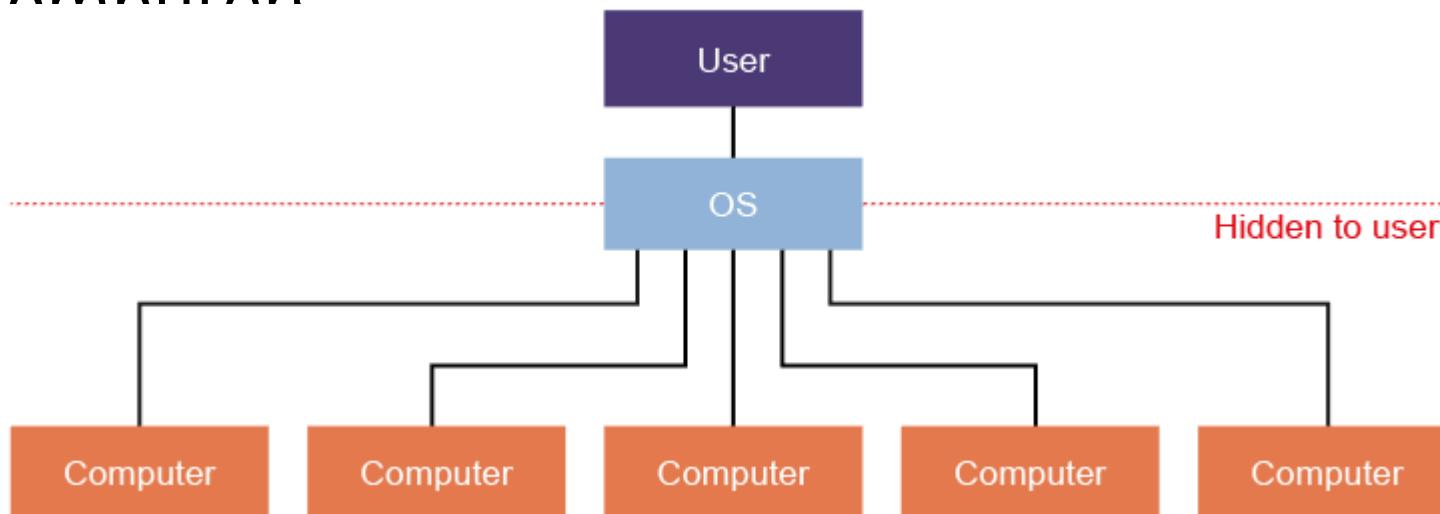
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Objectives

- Describe distributed, embedded, multi-tasking, multi-user and real-time operating systems
- Describe BIOS, device drivers and virtual machines

Distributed Operating Systems

- We already know that the operating system manages communication with the hardware
- A distributed OS can coordinate the processing of a single job across multiple computers



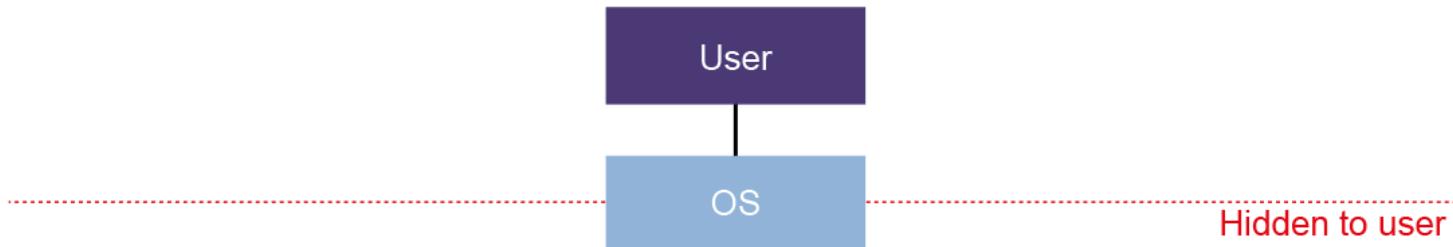
Distributed Operating Systems

- A program can be run by the user that uses data or resources from any other computer

- Resources could include processor time, memory and I/O facilities
- The distribution of tasks is coordinated by the OS passing instructions between computers

Distributed Operating Systems

- The user can access more computational power with the illusion of working with a single processor



- No need for training or writing programs differently

BUT

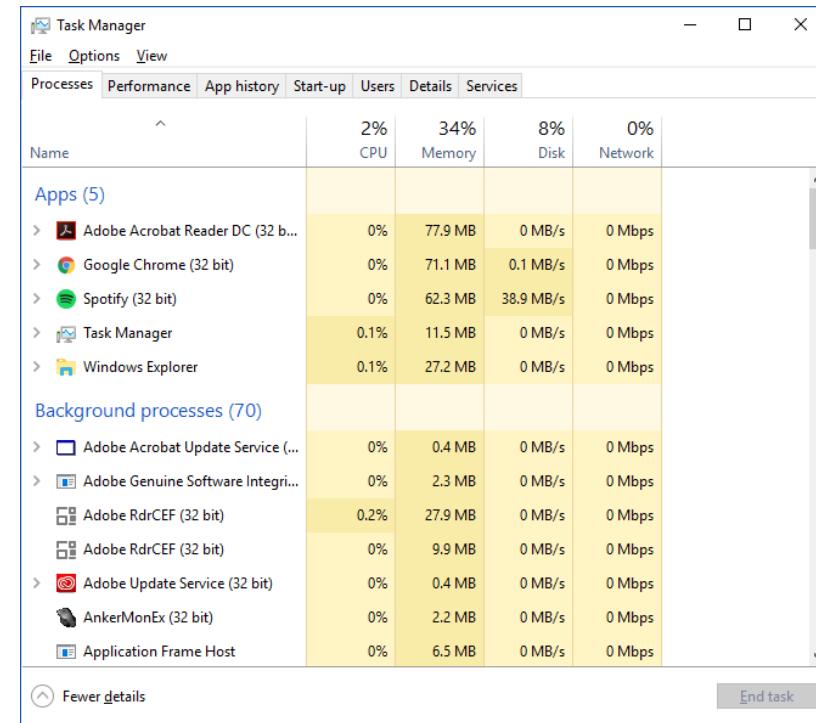
- The programmer has no control over the task distribution as this is entirely handled by the OS

Multi-tasking system

- A single processor can appear to do more than one task simultaneously by **scheduling** processor time

Reading a document, browsing the web and listening to music at the same time

Other processes are also running in the background



The screenshot shows a Windows Task Manager window titled "Task Manager". The "Processes" tab is selected. The table lists various processes across five columns: Name, 2% CPU, 34% Memory, 8% Disk, and 0% Network. The processes are categorized into "Apps (5)" and "Background processes (70)".

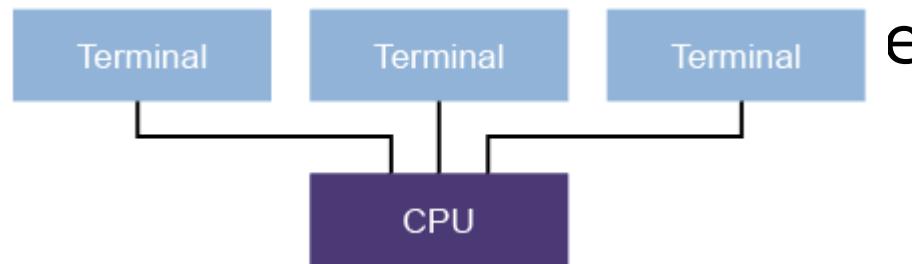
Name	2% CPU	34% Memory	8% Disk	0% Network
Apps (5)				
> Adobe Acrobat Reader DC (32 b...)	0%	77.9 MB	0 MB/s	0 Mbps
> Google Chrome (32 bit)	0%	71.1 MB	0.1 MB/s	0 Mbps
> Spotify (32 bit)	0%	62.3 MB	38.9 MB/s	0 Mbps
> Task Manager	0.1%	11.5 MB	0 MB/s	0 Mbps
> Windows Explorer	0.1%	27.2 MB	0 MB/s	0 Mbps
Background processes (70)				
> Adobe Acrobat Update Service (...)	0%	0.4 MB	0 MB/s	0 Mbps
> Adobe Genuine Software Integri...	0%	2.3 MB	0 MB/s	0 Mbps
Adobe RdrCEF (32 bit)	0.2%	27.9 MB	0 MB/s	0 Mbps
Adobe RdrCEF (32 bit)	0%	9.9 MB	0 MB/s	0 Mbps
> Adobe Update Service (32 bit)	0%	0.4 MB	0 MB/s	0 Mbps
AnkerMonEx (32 bit)	0%	2.2 MB	0 MB/s	0 Mbps
Application Frame Host	0%	6.5 MB	0 MB/s	0 Mbps



Multi-user, multi-tasking system

Some systems use a very powerful computer called a mainframe

- These might be seen in universities or large businesses
- Lots of users with their own terminals access the mainframe's CPU and each gets a time slice
- Each terminal processes



Mobile Operating Systems

- A smart phone is a computer with a multi-tasking Operating System
 - The iOS operating system on an iPhone for example, can run notes, calculator, to-do and phone apps at the same time



Mobile Operating Systems

- Mobile operating systems are linked to specific hardware
 - e.g. Android phones have different hardware to iOS phones
- A low level proprietary OS is used for handling the hardware and special features
 - Features include cellular connectivity and wi-fi
- Meanwhile, the main OS handles the user interface and running applications

Open source operating system

- **Android** is an open source OS based on Linux and owned by Google

- It is used by all major device manufacturers including Samsung, Motorola, Dell, Ericsson
- It allows for major customisation
- A device manufacturer can fine-tune the OS to suit their devices, and add additional features or user interfaces to enhance the user experience
- The interface and the available apps can be a major selling point

Worksheet 2

- Complete **Task 1** on the worksheet



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Embedded Operating Systems

- Many devices in your home have an OS and run simple programs

- How many examples can you think of?



Household devices

- The embedded OS has minimal features
- Application programs are held in ROM
- There is a limited amount of RAM
- The user interface is simple and minimal
 - What do you think the inputs and outputs would be for a household appliance?

Real time Operating Systems

• Some operating systems must operate in real time

- Must respond extremely quickly to inputs
- May need to cope with many inputs simultaneously
- Real time Operating Systems are usually seen in **safety-critical** environments
- If a hardware component fails, the OS must have a **failsafe** to detect this and respond appropriately
- There is hardware **redundancy** - crucial components are duplicated in case one fails

Case study - Therac-25

- 1980s radiation therapy machine with a **real time** embedded operating system
 - Patients were treated for cancer through exposure to targeted beams of radiation
 - Programming errors meant the machine responded incorrectly to certain real time inputs
 - Several people died as a result of accidentally being hit by massive radiation overdoses



Worksheet

- Complete **Task 2** on **Worksheet 2**

BIOS

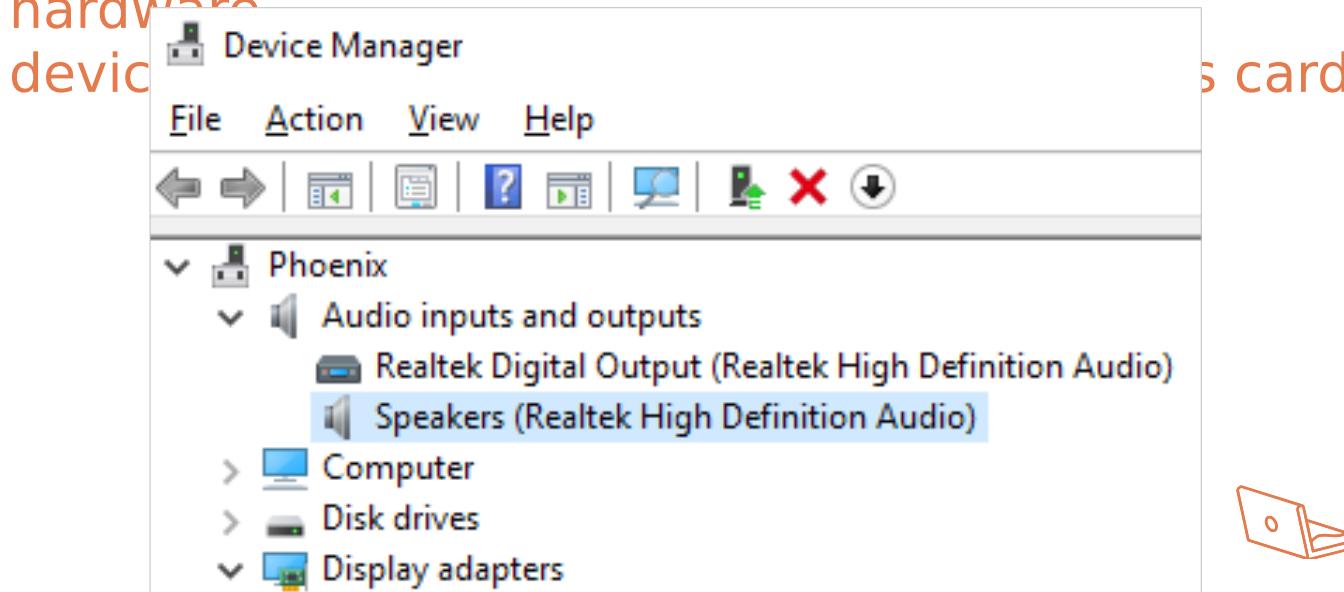
- BIOS (Basic Input Output System) is stored in ROM
- The BIOS boots the computer at start-up
 - Initialises and tests hardware
 - Loads the operating system



Device drivers

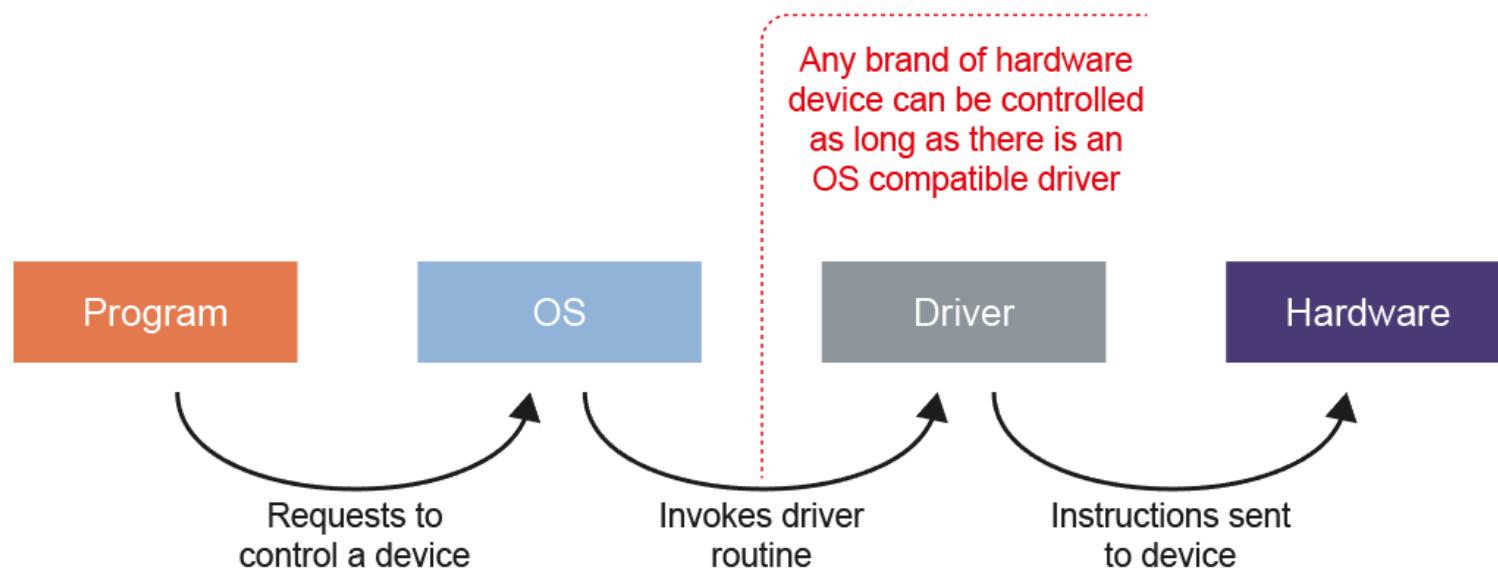
- A driver is a program that provides an interface for the OS to interact with a device
- Drivers are hardware dependent and OS specific

- Drivers are needed to allow the OS to control hardware



Device drivers

- The OS does not need to know the specifics of the hardware to be able to interact with it



Virtual Machine

- Software is used to emulate a machine
- Can be used for running one OS inside another to emulate different hardware
- A virtual machine can execute intermediate code e.g. Java virtual machine executes Java byte code
 - The MAME virtual machine can emulate the hardware of old arcade machines so that their games can be played on a modern PC



Plenary

- Operating systems can be
 - Distributed across multiple computers
 - Embedded into systems such as home appliances
 - Multi-tasking, for doing several things at once
 - Multi-user, to allow a mainframe's CPU to be shared
 - Real-time, to respond quickly when safety is critical
- The BIOS loads the operating system at boot time
- Device drivers allow the OS to control hardware
- Virtual machines are software emulating

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